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THE PHILOSOPHICAL REVIEW.

THE PHILOSOPHICAL ASPECTS OF EVOLUTION.[1]

AT the close of the year which marks the Darwin Centenary and the fiftieth anniversary of the publication of the *Origin of Species*, it seems to me peculiarly fitting that the American Philosophical Association, as well as other learned societies, should avail itself of the privilege of commemorating this event. I have therefore been minded to choose for the president's address, a subject having direct reference to that labor of thought which has placed the philosophical as well as the scientific world under a permanent debt of gratitude to Charles Darwin.

We of the present generation may be said to be living in the Darwinian age of thought. Every subject of research or of speculation during the last fifty years has been profoundly affected by the new methods and new problems which the doctrine of evolution has provoked. For philosophy, however, it has been not so much an introduction to new as a revival of old problems and methods. In an age which antedated the birth of Darwin and his years of patient and fruitful investigation, philosophical insight had already divined in broad outlines at least the program of evolution.

One of our most eminent biologists, Professor Osborn, president of the Museum of Natural History in New York, testifies most appreciatively of this anticipatory work of philosophy. In his historical study, *From the Greeks to Darwin*, he speaks of those pioneers in the field of evolutionary theory, Bacon, Leibniz, Kant, Lessing, Herder, Schelling and Hegel, as follows :

" It is a very striking fact that the basis of our modern methods of studying evolution was established not by the early naturalists,

[1] Delivered as the presidential address before the American Philosophical Association at Yale University, December 28, 1909.

nor by the speculative writers, but by the philosophers. They alone were upon the main track of modern thought."[1]

Thus the early prophecy of philosophy became later the triumph of science. But it is not what philosophy has contributed to science but rather the influence which science in its doctrine of evolution has exerted upon philosophical thought that is to be my theme on this occasion. This influence has been both various and significant. To Darwin and the Darwinian discussion, philosophy owes the rise of genetic psychology, genetic logic, the evolutionary theory of ethics, the historical study of religion and of our institutional life, both political and social. A new interest and meaning have been given to the philosophy of nature, and particularly to the question of man's place in the cosmos, and his relations to the animal world of which he is a part and to which he is kin. The *Origin of Species* carried with it a challenge, to investigate the origin of all our philosophical concepts, and assess them at their sources.

The first and most obvious questions of a philosophical nature, however, which were suggested by the Darwinian hypothesis and subsequent controversy, have either been answered according to a general consensus of opinion, or else the interest in them has abated because other more pertinent and significant problems have claimed their place.

I have particularly in mind three problems which have been subjected to the fiery trial of heated discussion, but which have been superseded each in turn by others, suggested by a clearer and more penetrating appreciation of the central issues involved.

I would designate these more significant issues as they present themselves to the philosophical thought of the day—problems of the second order—second however not in importance, but second in the sense of their having displaced the earlier and less discerning lines of inquiry.

The questions of a philosophical nature which were precipitated by the Darwinian doctrines were as follows :

I. The first we may regard as a special case of the origin of species—What is man ? Has he a common ancestry with the

[1] P. 87.

animal kingdom in general and particularly with his most closely allied species, the anthropoid ape—that droll caricature of human form, and crude but clever imitator of human activity? This question at one time stirred the philosophical and more especially the theological world to its depths, and yet it has long since lost its former interest. For, it is recognized that man's origin in this respect does not affect his present status. Other considerations determine that, and not his remote ancestry :—Does man at present represent a term in the series of evolution which has a unique worth and significance ? Is he in the animal progression and yet not of it ? Such are the problems which deserve a more careful consideration.

II. There is a second question which in the earlier discussions was debated with much vehemence and acumen on either side. It concerns the ground *motif* of a Naturphilosophie : Does the unfolding of the evolutionary series in forms increasingly complex give evidence of a teleological factor ? Darwin's contribution to our knowledge of the processes of evolution has tended to effect the elimination of the teleological factor. His description of the external features at least of a progressive development of plant and animal life through natural causes, particularly through the working of natural selection, has set aside the traditional explanation which was expressed in terms of a crude conception of an extrinsic teleology exhibited in the structure and function of specific organisms.

The question of purpose in nature has been superseded by that of purpose in human nature. Regarding man as a member of the organic series, what is the significance of the appearance in the midst of this series at a certain stage of an evident purpose, directing activity toward a definite end? What is the meaning of this peculiar fact, that what is concealed in nature is revealed in man?

III. The third question which was raised at the beginning of the Darwinian discussion, and which has failed of a satisfactory answer even to this day, is this: "Are the processes of life to be regarded as mechanical or are they vital ? " Mechanism has not as yet spoken the last word upon this subject. Its explanations are felt to be inadequate even on the part of the most hope-

ful of its advocates. We are not yet prepared for Haeckel's declaration that "Consciousness is the mechanical work of the ganglion cells."[1]

On the other hand, the older form of vitalism is out of court, and neo-vitalism has not yet made good its claims and promises, despite so eminent an advocate as Driesch. In the midst of such uncertainty, philosophy has turned its attention to another question, and upon it has seemingly centered for the present time its exclusive interest. It is this: Is not the unknown factor in evolution essentially unknowable? Is not the human intellect by reason of its very nature incapable of interpreting a continuous and progressive process such as that which is characteristic of plant and animal organisms? Is any theory of knowledge adequate to comprehend the infinite variety of life?

We will now turn our attention to the more particular examination of these three questions in the forms which during the progress of discussion they have now finally assumed.

I. In the early discussion concerning man's place in the cosmos both parties to the controversy were at fault. The one was afraid to face the facts lest man's dignity and worth might be impaired by the discovery of his lowly origin; the other, in interpreting the facts, fell into the snare of the genetic fallacy in assuming that the discovery of man's remote ancestry could be regarded in any sense as an explanation either of the process by which he had attained his present estate, or of the significance of that estate itself. The many points of resemblance between the human species and the rest of the animal world can neither belittle man, nor explain him. The supposition of the common origin of man and the higher Simian family only serves to emphasize the manifest differences of man and the ape at the present stage to which the processes of evolution have brought them both.

Going backward the lines converge to a common point; but from that point onward they diverge with an ever increasing distance in their separation. The Darwinian theory of natural selection cannot explain and was never intended to explain the origin of the process of evolution, or the ground of the course

[1] *Monism*, p. 47.

which it pursues. At best, natural selection acts, as De Vries characterizes it, like a sieve through which the already existing forms which nature assumes are impartially sifted. It is evident that it is a sieve which distributes the chances of death, and in no sense can it determine the basis of life. Evolution merely shows the existence of a process whose operation starts at one point in a developing series and continues to another ; and it is quite as incapable of explaining the nature of the origin as it is the significance of the goal. Professor Tyndall, for instance, places the first term of the evolutionary series at a distance far more remote than the beginnings of the plant or animal kingdom, discerning in the nebular star dust "the promise and the potency" of every form of life. And along the lines of this backward vision, it is necessary for every student of evolution today to reckon not only with the theory of organic but of inorganic evolution as well. Professor Tyndall, however, states most emphatically that " evolution does not, it does not profess, to solve the ultimate mystery of the universe. It leaves that mystery untouched. For granting the nebula and its potential life, the question, whence came they ? would still remain to baffle and bewilder us. At bottom the hypothesis does nothing more than transport the conception of life's origin to an indefinitely distant past."[1]

We must all concede what Darwin pointedly calls to our attention, as though in our pride we needed constantly to be reminded of it, that ' man still bears in his bodily frame the indelible stamp of his lowly origin.' Although we may have come from a stock which we share in common with the ape, nevertheless we have come a long way ; and although we have risen from the dust of the earth, and to that dust we return, yet the significant fact remains, that we *have risen*, and that for the brief space at least while thought holds sway over our lives we decline to be confused with this dust under our feet, or with the animal which follows to heel, or which mimics our bodily movements and gestures as he chatters to us from his cage.

Setting aside, therefore, this problem of origin which has been so widely debated in the course of the evolution discussion, there

[1] *Essay on the Use and Limit of the Imagination in Science*, p. 49.

is the present and more pertinent question, as to whether after all the difference now existing between man and the animal may not be regarded as a negligible factor. There are many who today would reduce this difference to such a minimum that it becomes practically a vanishing quantity. Darwin describes the difference between man and the animal as one of "degree and not of kind." [1]

This has been quoted so often and repeated with such satisfaction as a final explanation, that a due consideration of its real meaning has not been given—at least in certain quarters. It is easy to fall into the fallacy which I would characterize as *acquiescence in a reiterated formula*. Inasmuch as we form one of the terms of this relation, the difference between man and the animal, which is alleged to be one of degree and not of kind, may well challenge our attention, and more particular reflection.

In the first place, there is a question of fact involved. Is the only difference between man and the species of animal most closely allied to him, merely one of degree and not one of kind? Philosophers should not assume as true what biologists are to-day questioning. Professor Bateson, one of the most eminent of the British biologists, states in his recent essay on "Heredity and Variation in Modern Lights": "In the light of present knowledge it is evident that before we can attack the Species-problem with any hope of success there are vast arrears to be built up. He would be a bold man who would now assert that there was no sense in which the term Species might not have a strict and concrete meaning in contradistinction to the term Variety. We have been taught to regard the difference between species and variety as one of degree. I think it unlikely that this conclusion will bear the test of further research." [2] If this opinion holds good regarding the difference between species and variety, it will certainly apply much more forcibly to the difference between such widely separated species as man, and those animal forms most closely resembling him.

There is a second consideration, however: Even granting that all differences may be expressed as differences in degree, it does

[1] *Descent of Man*, p. 193.

[2] *Darwin and Modern Science—The Cambridge Commemoration of the Darwin Centenary*, pp. 94 f.

not necessarily follow that quantitative differences do not connote qualitative differences as well. On the contrary, not only among the phenomena of physical science, but also throughout the whole realm of the biological world, quantitative differences do have a commonly recognized qualitative significance. One indicates the presence of the other, but does not in the remotest manner explain it. A single quantitative difference, moreover, is sufficient to give rise to a set of qualitative changes of so marked a character as to constitute a wholly new species. The consequent changes which may possibly result, and which would seem to be out of all proportion to the initial change, occur according to the well known law in biology of correlative variation. Organs and functions so hang together that a seemingly insignificant quantitative change in one part often carries with it a marked transformation of the entire organism itself. It is simply begging the question to argue, for instance, that inasmuch as the human brain closely resembles the brain of the higher order of the anthropoid apes and as the only discernible difference is chiefly that of volume, or rather extent of effective surface, therefore the differences between the ape and man may be reduced at the last analysis to the quantitative one of brain dimensions. The very point at issue is not this obvious difference which is expressible in quantitative terms, but the question whether this difference of bulk is sufficient to account for the qualitative differences which are correlated with it, namely,—conceptual thinking, speech, the use of tools, the dominance over the animal world and the control of nature, a moral sense and religious aspiration, the faculty to look before and after, to learn from the past and to plan for the future.

It will be urged that animals show all of these seemingly characteristic features of man, though in a less degree. It is indeed true that animals do show the rudiments of all these so-called higher qualities of man. The significant point of it all is that they remain in the rudimentary stage generation after generation. And there is no evidence of any progress leading beyond what seems to be a final and complete stage of development. Man shows, however, a unique capacity of exhibiting in forms of increasing progression the limitless possibilities of the evolution process. In him all natural forces become tremendously acceler-

ated, so that from the standpoint of the method of evolution alone, aside from all other considerations, we have the significant phenomenon of a process unfolding its various forms after a manner common to all, until a form is reached which not only differs from all the others, but which marks a radical change in the very process itself by transcending its own limitations, enlarging its scope and determining its ends. Intellect may be potential in Darwin's "Simian ancestor with arboreal habits and caudal appendage," or even in Tyndall's "fiery cloud"; but it is actual in man and that too in a unique manner and degree.

Darwin has observed that if man had not been his own classifier, he would never have thought of founding a separate order for his own reception.[1]

This is, however, the most significant quality of the human species, that man can contemplate the process of which he is a part, and can become 'his own classifier,' and claim a unique *status* for himself. The very fact that man can critically study the process, formulate its procedure, classify its results and generalize its phenomena, is in itself a mode of transcending the very process itself. The cosmical forces at a certain stage in their development become reflective in man. Man is a philosophical animal. In his capacity for reflection, he exercises a gift that cannot possibly possess any 'survival value.' It brings to him no advantage in the struggle for existence. But in the satisfactions which accrue to him in giving free play to these inner compulsions of thought, he proves that thought is something more than an instrument of competition and that man himself is not actuated merely by animal needs and desires, but is capable of responding to a vocation which has a higher sanction than the forces of nature and the demands of a bare existence.

II. The question suggests itself at this point concerning the significance of the purposeful activities of man in relation to the natural process of evolution. Every system of naturalism seeks to eliminate all teleological factors from the course of nature. However successfully nature may be freed from the implication of purpose, it is not so simple or easy a task to explain away the fact of purpose in human nature.

[1] *Descent of Man*, p. 231.

Professor Huxley draws attention to the fact that Darwin's originality consists in showing how harmonies which had been regarded as implying the agency of intelligence and will, could be explained without any such intervention.[1]

However, such explanation is wholly inadequate concerning the conscious free purposes of man. For while man is a product of the evolutionary process he is also a determining factor—a factor of such consequence that it has made man the dominant species of the earth. The various forces of the universe operating for ages according to natural law and tendency, with no evidence of purposeful activity, nevertheless develop out of themselves an order of being whose essential nature it is to adapt means to ends, not only those most immediate, but also those most remote. The appearance of man in the evolutionary series is an indication that the later stages of an apparently continuous development may not be due to the same causes only as the earlier stages.

The making of a man may not have been the definite end of the evolutionary process, but man himself has made it the end. He has compelled the processes of nature to minister to his well-being and progress. If the world was not made for him, he has nevertheless appropriated the world to his own use and purpose.

By reason of this teleological endowment, man's development is a conspicuous illustration of orthogenetic evolution, of a straight-forth progress toward an end which is the realization in the most complete manner of the sum-total of his varied possibilities. This is something more than the ability to attain certain specific ends as they may become objects of desire from time to time in the course of the daily routine of life. For man possesses a capacity also of coördinating the various separate ends of his experience in some single aim which comprehends them all, and which exercises a unifying function over his activities and desires. Moreover, the ends of the individual are also coördinated with those of his fellows in such a manner as to constitute a society, ordered by the play of those human forces which tend to unify the various parts of the social organism. And in every such organism there is an exhibition on a large scale of an immanent finality.

[1] Huxley, "Criticism on the Origin of Species," *Collected Essays*, Vol. II, p. 102.

This possession of an intelligent purpose on the part of man has given him an immense advantage in that struggle for existence which lies at the basis of the Darwinian hypothesis of natural selection ; and for the processes of evolution as they are today operative, this teleological factor has an exceedingly intimate and important significance.

Alfred Russell Wallace gives his very emphatic estimate of this intellectual factor of evolution in the following passage, which was first written in 1864 and which has been re-stated by Wallace in a recent article published in the *Fortnightly :*

" At length, however, there came into existence a being in whom the subtle force we term *mind*, became of more importance than his mere bodily structure. Though with a naked and unprotected body, *this* gave him clothing against the varying inclemencies of the seasons. Though unable to compete with the deer in swiftness or with the wild bull in strength, *this* gave him weapons with which to capture or overcome both. Though less capable than most other animals of living on the herbs and fruits which unaided nature supplies, this most wonderful faculty taught him to govern and direct nature to his own benefit, and make her produce food for him when and where he needed. From the moment when the first skin was used for a covering, when the first rude spear was formed to assist in the chase, when fire was first used to cook his food, when the first seed was sown, or shoot planted, a grand revolution was effected in nature, a revolution which in all the previous ages of the earth's history had had no parallel, for a being had arisen who was no longer necessarily subject to physical change with the changing universe, a being who was in some degree superior to nature, inasmuch as he knew how to control and regulate her action, and could keep himself in harmony with her, not by change in body, but by an advance in mind." [1]

Man, regarded as the child of nature, nevertheless develops a power under the influences of nature herself, which in turn commands and subdues these natural forces to his will and bidding.

Professor Osborn has designated the four inseparable factors of evolution as heredity, ontogeny, environment, and selection; vari-

[1] *The Fortnightly Review*, N. S., Jan. 1, 1908, p. 14.

ation he also mentions but regards it in the light of a secondary factor.[1] Man, by the light of reason, and the strength of will, has essentially modified all of these factors, and at times has completely neutralized one or more of them. The natural course of the hereditary process must have experienced some radical transformation when man first appeared as an off-shoot of the Simian stock. Characterize it as an extreme variation, as a mutation, or as the development of a recessive into a dominant factor, or of a potential into an actual, or what you will, the fact remains that certain new and definite determinants must have appeared in the midst of the old. For the natural processes of heredity, whether we regard them as simply conserving the original germ-plasm, or as gradually accumulating the natural gains and accomplishments of a race experience, are not sufficient alone to account for the unique, unannounced, and unanticipated evolution of man. Moreover, so far as his ontogenetic development is concerned, the human being possesses so large a capacity of educability that the progress of a single generation brings to him acquisition and achievement incomparably superior to that which other orders of the animal kingdom can show through ages upon ages.

It is in reference to his environment that man's power and unique position are most conspicuously shown. He not only knows how to adapt himself to his environment, but he knows how to adapt his environment to himself. He does not wait for natural selection to promote him on the one hand, or on the other to degrade and destroy him. He is master of his fate ; he compels his surroundings to serve his need and desire. Moreover, by virtue of his intellectual endowments man shows an increased tendency toward variation. In originality and in inventiveness he puts forward his progressive development in knowledge and efficiency by immense stretches. Professor Osborn shows in the same article to which I have referred above that when one of these factors varies, all the others vary with it. Consequently man, who is able to cause all of these factors to vary at will, brings into the natural course of evolution determining factors of profound significance and far-reaching influence. The terms which are used to describe the process of evolution before the appearance

[1] *Science*, N. S., Vol. XXVII, p. 148.

of man are wholly inadequate to describe those processes after his appearance. So far as man is a product of the preceding stages of evolution, he may be regarded merely as one term among many of an indefinitely continued series; but, so far as he is the dominant factor in the course of his own development, giving character and determination to it, he is unique, and in this respect at least cannot be grouped with any other order of animal, however closely they may resemble him in form and function, or in the crude exercise of a rudimentary intelligence. What such a man as Charles Darwin alone has accomplished in modifying the character of the race far transcends our powers of estimation, or of conjecture.

Not only has man determined in a large measure the course of his own development, but the evolution of the human factor in the series has also modified in many essential features the process of the series itself. Man's occupation of the earth has changed the natural environment both of plants and of animals. Entire species have been exterminated ; others have been protected and cultivated. Deserts have been turned into fertile fields, and fertile fields into waste places. Fauna and flora alike are affected by the introduction of the human factor into their environment. Man has become a directive force in evolution. The process of natural selection is being constantly modified by human selection. The experiments in agriculture on a large scale, the selective breeding of domestic animals, the preservation of game, the special culture of fish in almost every stream and lake in the civilized world, the domestication of wild animals, the production of new varieties of fruits and vegetables—all indicate that man's control of the phenomena of life exerts an influence upon the evolutionary series of a permanent and essential character.

This then is the paradox of evolution, that a process giving no evidence of intelligent purpose develops a product whose characteristic feature is purposeful activity ; that what is a product, becomes a determining factor in the subsequent development of the process ; and that natural selection produces an effect, capable of modifying and at times defeating the influences of natural selection itself by reason of that very selective faculty which these influences originally evolved.

III. There is a third problem, which has grown out of the earlier controversies between the advocates of mechanism and of vitalism. It is insisted in certain quarters that all vital processes are essentially of such a nature that the human intellect is incapable of comprehending them, at least by the ordinary procedure which logical habit pursues in the investigations of other sciences. Fechner in *Einige Ideen zur Schöpfungs- und Entwickelungsgeschichte*, James in *A Pluralistic Universe*, Bergson in *L'Evolution Créatrice*, Underhill on the "Limits of Evolution" in the Oxford essays on *Personal Idealism* and more recently still Waggett on "The Influence of Darwin on Religious Thought" in the *Cambridge Centenary Volume* — all present from their different points of view a more or less scathing indictment of logic, on the ground of its inadequacy to interpret the characteristic features of the living processes of nature. Our conceptual intelligence, it is urged, reaches its natural limit at the point where it begins to concern itself with vital phenomena. It represents superficial aspects ; but fails to penetrate beneath the surface of things. Bergson, for instance, expresses this general point of view in his characteristic manner : " Mais de là devrait resulter aussi que notre pensée, sous sa forme purement logique, est incapable de se représenter la vraie nature de la vie, la signification profonde du movement évolutif. Créé par la vie, dans ses circonstances déterminées, pour agir sur des choses déterminées, comment embrasserait-elle la vie, dont elle n'est qu'une émanation ou un aspect ? Déposée, en cours de route, par le mouvement évolutif, comment s'appliquerait-elle le long du movement évolutif lui-même ? Autant vaudrait prétendre que la partie égale le tout, que l'effet peut résorber en lui sa cause, ou que le galet laissé sur la plage dessine la forme de la vague qui l'apporta. De fait, nous sentons bien qu'aucune des catégories de notre pensée, unité, multiplicité, causalité mecanique, finalité intelligente, etc., ne s'applique exactement aux choses de la vie: qui dira où commence et où finit l'individualité, si l'être vivant est un ou plusieurs, si ce sont les cellules qui s'associent en organisme ou si c'est l'organisme quise dissocie en cellules?"[1]

Regarding the indictment of the conceptual processes of logic more in detail, we find that it consists of several counts:

[1] Henri Bergson, *L'évolution créatrice*, Introduction, p. ii.

Logic, it is held, is incapable of interpreting the continuous. It represents finished products but not the processes themselves ; it deals with what is, but not with what is becoming. Mr. Underhill expresses this idea in the following paragraph :

" Logically the task before the mental evolutionist is the same as that before the biological evolutionist. He must start with the ultimate fact of conscious mind ; he must discover the permanent laws of mental processes . . . ; but here, just as much as in the changes of the inorganic sphere, and as in the vital process of the organic sphere, the actual processes involved, will *ipso facto* elude his understanding. Mental products and the laws and stages of their production, these constitute his science. The real process is beyond him, the process as it actually goes on in fact."[1]

And in a similar vein, Bergson states, " Notre intelligence, telle qu'elle sort des mains de la nature, a pour objet principal le solide inorganisé. . . . L'intelligence ne se represente clairment que le discontinu—"[2]

It is urged also that the conceptual intelligence fails to represent adequately the special case. The particular bit of experience, pulsing with life, and warm with a sense of intimate reality, becomes cold and dead when tabulated as an instance and illustration of a universal idea, whose verbal expression has long since become stereotyped, and consequently depotentiated of its full meaning.

Mr. P. N. Waggett, in his " Essay on Darwin and Religious Thought," expresses this criticism of our conceptual processes from the standpoint of religion: " The conception of uniformity which is a necessity of scientific description has been taken for the substance of history. We have accepted a postulate of scientific method as if it were a conclusion of scientific demonstration. In the name of a generalization which, however just on the lines of a particular method, is the prize of a difficult exploit of reflexion, we have discarded the direct impressions of experience ; or, perhaps it is more true to say, we have used for the criticism of alleged experiences a doctrine of uniformity which is only valid in the region of abstract science."[3]

[1] *Personal Idealism*, p. 218.

[2] *L'évolution créatrice*, pp. 167, 168.

[3] *Darwin Centenary Volume*, p. 478.

It is also alleged that conceptual thought fails to interpret adequately the relation of cause and effect. Professor James expresses this in his chapter on " Bergson and Intellectualism " : "Concepts, in the deeper sense of giving *insight*, have no theoretic value, for they quite fail to connect us with the inner life of the flux, or with the causes that govern its direction. Instead of being interpreters of reality, concepts negate the inwardness of reality altogether. They make the whole notion of a causal influence between finite things incomprehensible. No real activities and indeed no real connexions of any kind can obtain if we follow the conceptual logic ; for to be distinguishable, according to what I call intellectualism, is to be incapable of connexion."[1]

Moreover, the logic which is under indictment, it is insisted, fails utterly to account for the acknowledged contradictory elements in our experience. While a conceptual logic by its very nature separates ideas one from another, and lays down lines of mutual exclusion, the actual experiences of life on the contrary continually force upon us the contradictory, the incompatible and the incongruous.

Such is the case against conceptual logic, and I believe most profoundly that these strictures arise from a misapprehension of the true function of logic. If it is the mechanical thing which these statements imply, not only knowledge of living processes and experiences would prove impossible, but any knowledge whatsoever,—of the flux of things, or of the forms of established solidity ; of the phenomena of dynamic change, or those of static repose. In fact, the logic underlying the criticism is so far from superior to the logic that is the object of the criticism, as to indicate most conclusively that the logic under indictment is a logic falsely conceived, and is never employed in the actual processes of thought either critical or reflective. Intellectualism can be attacked only by the weapons of intellectualism itself ; and the more successful the attack, the more conspicuous is its futility.

I believe that the processes of logic have a far wider scope, and a less mechanical function than these criticisms imply, and that as a matter of fact the activities of thought are actually akin to

[1] *A Pluralistic Universe*, p. 246 f.

the organizing forces of life themselves which they are supposed to be wholly incapable even of representing.

The charge is made against conceptual thinking that it cannot portray life because it cannot portray the continuous. On the contrary, it is the peculiar function of our thought to represent the continuous. Our perceptual intelligence sees things in detached fragments; our conceptual thought integrates them into a continuous whole. I may not be able to see a process but I can think it. In the most conceptual of all processes, the mathematical, there has been devised a method by means of which differential elements, essentially discrete, are capable of integration. While conceptual thought possesses the analytical power of separating a given process into elemental parts, into discrete portions of space, or separate instants of time, it must not be overlooked that it functions also in a synthetic capacity, by means of which the connecting lines of continuity are established so that the mind can hold together the elements in one undivided whole. It not only separates the curve of the ellipse into its differential elements, but those elements in turn it constructs into the continuous curve. The ellipse can be regarded as a point in motion whose direction changes continuously. The conceptual logic is capable, moreover, not only of grasping the fact that there is change such as this, but it can discover and formulate the law of this change. Here the change is uniform, and it might be urged that because it is a mere mechanical process, it can be thus determined and expressed. It is possible, moreover, to determine and express a law where the change is not uniform, but proceeds at an accelerated rate, as the law of falling bodies. Thus we are able to express by our logical processes how change itself changes. Inasmuch as the rate of change is uniform, the varying increment admits of exact formulation. The question however naturally suggests itself at this point: Can vital processes of change be thus formulated? Here the law of change is not apparent. And yet it is a wholly gratuitous assumption that therefore there is no law of change at all; or that, if there is, the changing process is of such an order that our intellects by their very nature are incapable of appreciating it. It is quite as reasonable to suppose that vital processes elude our mental grasp because of their exceeding great

complexity. There is, moreover, every indication from the results of biological investigation of recent years that the continuous changes in the vital processes proceed according to law, and although according to a law at present unknown, yet not necessarily unknowable. In the understanding of this problem the frontiers of our knowledge have been pushed forward in a most astonishing manner, and by methods and hypotheses which are essentially intelligible. It is not a new logic that is needed, but further advances of the old. The complexity of the processes is being reduced to simpler and simpler terms. In the rapid progress of experimental results in biology, there is not the faintest suggestion that the processes of evolution are in any sense capricious or lawless.

The most complex of all the processes of life, that of the continuous development of the race in unbroken line from generation to generation, has been simplified to an extent which a decade ago it would have been impossible even to conceive, by the rediscovery in 1900 of the work of Mendel, and the formulation of the Mendelian law. This marked the era of the introduction of order into a confused mass of biological phenomena.

Bateson in his essay on "Heredity and Variation in Modern Lights" speaks of this discovery in a most significant manner as follows : " Those who had a preliminary acquaintance with the facts of Variation were not wholly unprepared for some such revelation. The essential deduction from the discovery of segregation was that the characters of living things are dependent on the presence of definite elements or factors, which are treated as units in the processes of Heredity. These factors can thus be recombined in various ways. They act sometimes separately, and sometimes they interact in conjunction with each other, producing their various effects. All this indicates a definiteness and specific order in heredity, and therefore in variation. This order cannot by the nature of the case be dependent on Natural Selection for its existence, but must be a consequence of the fundamental chemical and physical nature of living things. The study of Variation had from the first shown that an orderliness of this kind was present. The bodies and properties of living things are cosmic, not chaotic. No matter how low in the scale we go, never do we

find the slightest hint of a diminution in the all-pervading orderliness, nor can we conceive an organism existing for a moment in any other state."[1]

I have quoted the paragraph somewhat at length in order to show the direction which the biological research of today is taking. It is towards an intelligible account of the vital processes. The 'orderliness' of these processes does not mean necessarily that they are to be eventually explained in a purely mechanical way; on the contrary, according to Mendel's law the elements entering into the varied combinations are still vital units.

It does mean, however, that whether the secret of life is to be discovered in an original *élan vital* as Bergson puts it, or in an *entelechy* as Driesch emphatically insists, or in *the elementary accumulators of nervous energy* acting after the manner of electrical phenomena, as Rignano conceives it, it must as the inner spring of life operate according to the law of its own nature, and exhibit as its essential features order and regularity. And if it exhibits order and regularity in its functioning, it is so far forth intelligible, and there is, to say the least, no presumption against its being conceptually discerned. Every presumption favors an intelligible process, expressible in terms of law or laws.

I believe most profoundly that the processes of thought are essentially the processes of organization, and not of mere "fabrication" as Bergson very stoutly insists.[2] For thought does not work upon its material from without, combining part to part in an external way, but it works from within after the manner of the architectonic principle of a plant which accumulates its material and informs it, building up its structure by building it into its own nature. It is just because the thought processes are vital, organic, metabolic, that I believe they possess no inherent incapacity for interpreting the phenomena of life.

Another count against logic is that it fails in dealing with the special case; that there is always something about the concrete instance which no abstract category, rubric or formula can adequately cover; that what is needed is a logic of particulars, that conceptual logic must carry on its process by means of universal

[1] *Darwin Centenary Volume*, p. 92.
[2] *L'évolution créatrice*, p. 100.

ideas, and the universal is but a spectral representation of the living reality. Of course an artificial and mechanical view of the relation of the universal to the particular in logic will justify this contention that the conceptual logic can deal with mechanical rigidly set relations, but not with vital processes or experiences. I am bold enough and possibly some may add rash enough to quote Hegel in this connection, and insist that "the particular is the universal." The relation between the universal and particular in our knowledge is not an external one; but it is essentially organic. Darwin who in his thinking was so conspicuously fertile in generalization, was preëminently the expert investigator of the special case. He was not content to note an exception merely as such, and then dismiss it from his mind. Every exception was a challenge to him to discover its ground; and the discovered ground in turn became at once the occasion and reason for modifying the general law. Darwin's studies in variation were an attempt to search out the rationâle of particularization. My colleague, Professor Edwin G. Conklin, in a recent article on *The World's Debt to Darwin* comments as follows upon this particular phase of Darwin's labors:

"The positive side of Darwin's theory, and indeed of every other theory of evolution, is the *variability* of organisms, and the principal question which confronted him as it confronts every evolutionist today, was this: 'What is the nature and what are the causes of variation?'"[1]

In seeking the causes of variation, Darwin was profoundly convinced that every particular instance has a universal significance,—that is, it can be ultimately embodied and expressed in a general law. And every student of science today, every serious scholar in whatever field of research feels a compulsion to discover the light of the universal, in order that it may illumine the particular phenomenon under investigation. It is impossible to disclose the nature of the particular case without some insight into the relations which it sustains to certain determinants having a universal and necessary significance. In the investigation of the vital processes of nature, the causal necessity may be veiled, and the supposed universality confronted with outstanding excep-

[1] *Proceedings of the American Philosophical Society*, Vol. XLVIII, p. xlvi.

tions; nevertheless it is the fundamental belief in some underlying necessity and universal relation which spurs endeavor to persevering research, and renders the mind impatient of inexact methods and inadequate results. Bergson, James, and others of the same way of thinking, take a very circumscribed view of conceptual logic, when they regard it as a process of subsumption—of describing the special case only so far as it fits into a ready-made group idea. Thinking always becomes mechanical and inadequate when the particular instance is seen only in the light of doctrine, or of theory.

No biological discovery may be due to pure reason, as Bergson maintains[1] but on the other hand no discovery in biology or any other science has ever been due to pure observation unaided by the collaborating function of the intellect in discovering its universal significance.

It is true that actual concrete experiences rich in content and instinct with life cannot be comprehended in abstract categories. Our thought forms, however, are not stereotyped. It is only a very crude logic which regards its function as one of reference of particulars to fixed forms. The particular case is illuminated by the universal ; it is never absorbed or exhausted by it. Logic then is not subsumption but interpretation ; and the process is a vital one in this sense, that there is a constant reciprocal action between the particular phenomenon and the universal concept which we employ to interpret it. To use a phrase of Professor James, there is a constant " endosmosis " or conflux of the particular with the universal in our knowledge. Professor James applies this characterization to the relation of particulars to particulars in experience. It applies equally well to the relation of particulars to the universal.

Every change in one is reflected in the other. Every separate experience leaves a deposit of its particular significance in the corresponding concept, enriches it, makes it living knowledge, because of the very fact that it is capable of change and growth. For there is a growth in conceptual knowledge, an organic growth, in which the material elements of experience are being constantly appropriated and assimilated. The influence of Darwin upon

[1] *L'évolution créatrice*, p. iii.

logic is most conspicuous and significant in reference to the theory of classification. Modern logic does not conceive of its concepts as water-tight compartments. They possess no inevitableness of solidity about them. They do not form a closed system. They are mobile, fluid, plastic. They take a form which is ever changing with enlarging experience. The modern theory of classification today provides for limiting cases, for the arrangement of its terms in a serial order of progression, for the merging of one class into another, for a wide range of variations about a type, for the appearance even of *mutations* which are unexpected and unannounced. New forms are not discarded because there is no place for them, but they are given a place which they themselves compel. Every system of classifying vital phenomena is a living system, subject to constant change and adjustment. It is after this manner that Darwin built up his body of knowledge, a body having the spirit of life, and not a mass of dead immobile elements. However, on the other hand, a study of particular instances without conceptual knowledge as an instrument of interpretation and of direction would prove a wholly confused and futile undertaking. Bateson has given a very illuminating statement concerning the method of investigating the particular phenomenon: "To those who have made no study of heredity, it sometimes appears that the question of the effect of conditions in causing variations is one which we should immediately investigate, but a little thought will show that before any critical inquiry into such possibilities can be attempted, a knowledge of the working of heredity under conditions as far as possible uniform must be obtained."[1] He emphasizes here the necessity of having some knowledge of the law of uniform behavior in general, in order to interpret the variations which may occur in particular instances. Variations have meaning only when the type has been established, and is duly recognized as such.

Höffding in his essay on *Evolution and Modern Philosophy* insists that "evolutionism and systematism are opposing tendencies which can never be absolutely harmonised one with the other. Evolution may at any time break some form which the system-monger regards as finally established." And he quotes Darwin

[1] *Darwin Centenary Volume*, p. 95.

as saying in point — "I had thought the same parts of the same species more resemble (than they do anyhow in Cirripedia) objects cast in the same mould. Systematic work would be easy, were it not for this confounded variation which, however, is pleasant to me as a speculatist, though odious to me as a systematist." [1]

It is to Darwin's everlasting glory that he overcame this seeming opposition, and gave the world an object lesson in true logical procedure, by constructing a working system which was capable of rationalizing his facts, and yet at the same time sufficiently elastic to modify its own lines so as to comprehend new varieties and seeming exceptions. Darwin was essentially a system maker; but his system was made for facts, and not facts for his system.

As a corollary to this conception of the relation of systematic knowledge to the variable instances which it comprehends, there is the problem of the reconciliation of the contradictories which experience exhibits, and which it is alleged our logical concepts are incapable of interpreting. Here again it is only an artificial view of logic which regards its concepts as set with an iron rigidity.

Professor James insists that "for conceptual logic the same is nothing but the same." [2] This bare statement of the law of identity modern logic repudiates most emphatically. The essential nature of the concept is that it represents unity in the midst of difference, identity in variety ; and this is richly illustrated in those great constructive concepts of science whose characteristic feature has been the effort to confine in one idea the reciprocal action of opposed forces. Such are the concepts of action and reaction, attraction and repulsion, stress and strain, positive and negative electricity, north and south poles of the magnetic field, endosmosis and exosmosis, anabolism and catabolism. All of these express a synthesis of opposed elements. And in the light of concepts such as these, it is absurd to declare that the essential nature of concepts is that of rigid exclusion and unrelated isolation.

If our intellect is incapable of aiding us in the interpretation of

[1] *Op. cit.*, p. 457.
[2] *A Pluralistic Universe*, p. 257.

nature, what faculty will lead us to the light ? Bergson suggests that there is an intuitive faculty of apprehension by means of which in the concrete experience we come to know life as it is. This comes from immediate insight, and not reasoned knowledge. Our intuitive faculty we are constantly sacrificing to the demands of our intelligence. Intuition is a higher order of knowledge ; and we are content foolishly to follow the lead of the lower. " L'intuition est l'esprit même, et en un certain sens, la vie même." [1] From this fervent declaration of Bergson, we see that he is by nature an intellectual mystic, and it is through the mystical interpretation of life that he hopes the more fruitful results of knowledge will appear. Similarly Professor James holds that knowledge is born through " a stroke of intuitive sympathy." [2]

However, even if knowledge of the deeper mysteries of life is to arise in intuitive apprehension, such knowledge is so much unavailable energy. It must be transmuted sooner or later into intelligible forms if it is to be available for intelligent beings. Of course life is more than logic, and actual experience more than knowledge. But knowledge is the interpretation of life, and there can be no progress in experience without an accompanying endeavor on our part to interpret it. We are accustomed to regard the poetical insight as that which most correctly interprets life ; yet the poet is not one who simply feels the thrill of being in its infinitely various manifestations. His function is to express the feeling which his intuition discloses. And he merits the distinction of a poet only so far as his expression sounds a universal note. Shakespeare was preëminently the potrayer of particular characters. And yet in his plays every individual stands out as a universal type. The ability to express the concrete particular in universal form is the great poet's consummate gift. I believe most profoundly in the knowledge that is born of insight, unreasoned and at times seemingly unreasonable, and yet if it is to acquire a distinct value and significance for us we must admit it to a permanent place in our body of knowledge as a whole.

At a time when we are celebrating the achievement of Darwin and his followers in the study of the processes of life, I would enter

[1] *L'évolution créatrice*, p. 290.
[2] *A Pluralistic Universe*, p. 263.

a vigorous plea for the presumption which such achievements create, namely, that, the possibilities of intellectual progress in this field are by no means exhausted ; that new experiences are certain to arise, but not a new order of experience ; that the intellectual organization of knowledge can never give place to the particular and isolated glimpses of truth which a mystical intuition may be capable of apprehending, but that such glimpses of the truth must themselves become the possession of the intellect, or they will prove evanescent and illusive.

It is the peculiar duty and privilege of philosophy, moreover, to exalt the prerogatives of intellect. Let it not be thought that the intellect is compelled to go into bankruptcy, or that we who are its followers are called upon to declare the repudiation of its obligations. I do not for a moment believe that science and philosophy have been for ages on the wrong road, or that the treasures of the past are not to be richly conserved in the progress of the future. It is possible that the intellect may be but a single and indeed a very insignificant phase of " a force far more vast and profound," as Bergson declares. It is an interesting conjecture, one to play with in an idle mood of speculative fancy, but it can never be a working hypothesis, nor a truth to build or to rest upon, or to allure us to turn aside from the main course of intellectual evolution in order to follow its uncertain light into unknown and possibly barren fields. Knowledge may never comprehend life in its fullness ; for knowledge is the interpretation of life and not its duplication. On the other hand, that intuition which is ' life itself ' can for that very reason never be knowledge.

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